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**Title: Auditory verbal hallucinations: Social, but how?**

**Summary:** Auditory verbal hallucinations (AVH) are experiences of hearing voices in the absence of an external speaker. Standard explanatory models propose that AVH arise from misattributed verbal cognitions (i.e. inner speech), but provide little account of how heard voices often have a distinct persona and agency. Here we review the argument that AVH have important social and agent-like properties and consider how different neurocognitive approaches to AVH can account for these elements, focusing on inner speech, memory, and predictive processing. We then evaluate the possible role of separate social-cognitive processes in the development of AVH, before outlining three ways in which speech and language processes already involve socially important information, such as cues to interact with others. We propose that when these are taken into account, the social characteristics of AVH can be explained without an appeal to separate social-cognitive systems.

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## **Auditory verbal hallucinations: Social, but how?**

### **Introduction**

Auditory verbal hallucinations (AVH) – or hearing voices – are perceptions of speech that occur in the absence of the appropriate sensory input, such as an external speaker. They are typically defined as having a sense of reality; that is, they are experienced as a veridical perception, just as if one was hearing a person speak (David, 2004). AVH are a feature of a number of psychiatric disorders, including schizophrenia, but can also occur in a minority of the general population without any need for care (Johns et al., 2014), and can be prompted by stressful life events, including bereavement (Castelnovo, Cavallotti, Gambini, & D'Agostino, 2015). While some heard voices can be positive, neutral, or supportive, many AVH are experienced as negative, unpleasant, and upsetting (Woods, Jones, Alderson-Day, Callard, & Fernyhough, 2015).

Because of the experience's perceptual and verbal nature, the majority of research on AVH has focused on how voice-hearing may arise from disruptions to speech and language processing. For instance, a prominent theoretical approach has been to characterize AVH as instances of misattributed verbal cognition, or inner speech (e.g. Allen, Aleman, & McGuire, 2007). However, it has been noted that thinking about voices as misattributed verbal thoughts may miss another important aspect of AVH: namely, their often distinct character or persona (Frith, Lawrence, & Weinberger, 1996; Nayani & David, 1996). Furthermore, many voice-hearers talk about their voices as if they were independent agents capable of a range of complex speech acts. For example, a voice-hearer in a recent phenomenological survey by Woods et al. (2015) stated:

‘I hear distinct voices. Each voice has their own personality. They often try to tell me what to do or try to interject their own thoughts or feelings about a certain subject or matter’ (Woods et al., 2015, p325).

Descriptions of this kind have led some theorists to argue that AVH are experienced as much as social entities as they are perceptual objects (Bell, 2013; Wilkinson & Bell, 2015). In support of this idea, a variety of psychological interventions have recently been developed that depend on working with these personified and social qualities of AVH in different ways, including voice dialoguing (Corstens, Longden, & May, 2011), AVATAR therapy (Leff, Williams, Huckvale, Arbuthnot, & Leff, 2014), and relating therapy (Hayward, Berry, & Ashton, 2011; Paulik, Hayward, & Stain, 2013). Key to each is the idea that the voices heard in AVH can be treated as agent-like entities, and that understanding them in this way can have therapeutic benefits for the voice-hearer (Deamer & Wilkinson, 2015).

If AVH are regarded as primarily auditory and linguistic phenomena – that is, as aberrant perceptions of language, but not much more than that – how and why do they possess these apparently social characteristics? That is, how is it that many of them have a distinct identity and personality, which can be interacted with almost as if they represented the utterances of a real person? The aim of this article is to review some of the ways in which current neurocognitive and psychiatric models can account for these broadly-termed social aspects of AVH. We argue that existing explanatory models of AVH can ultimately account for these phenomena, but only by recognizing how social cues and other kinds of social information are embedded in the ordinary processing of speech and language processes.

In Section 1 we review the evidence that AVH have social characteristics and that, in many cases, this is centrally important to understanding the nature of the experience. Section 2 evaluates how current neurocognitive approaches account for the social

characteristics of voices, focusing on three such approaches in particular: inner speech, memory, and predictive processing. Section 3 assesses various ways in which ideas from developmental and social-cognitive theories could be drawn upon to enhance existing explanations of AVH, while section 4 outlines three ways in which speech-based models in particular could ultimately accommodate the social features of voice-hearing.

## **1. The importance of the social characteristics of AVH**

Recently Bell (2013) and Wilkinson and Bell (2015) have presented a series of arguments for thinking that many AVH are primarily experienced as social entities or representations, rather than (or, rather than just) auditory perceptions. (Here, social is meant in the sense of implying a speaker or communicative agent that could hypothetically be interacted with) We propose that Bell and Wilkinson's approach can be roughly characterized as combining two main arguments: one regarding the content of AVH, the other regarding its form. This section will review these two arguments, and deal with one main objection: namely, that the social characteristics of AVH are merely secondary elaborations or appraisals of the primary, core phenomenon – auditory hallucination – and thus are not central, in any important sense, to understanding AVH.

### *1.1 Two arguments for AVH as social entities*

The argument regarding content is simply descriptive: many (if not the majority) of AVH are described as if they are social or agent-like entities of some kind. In a recent phenomenological survey, approximately two-thirds of voice-hearers described their voices as having their own character or persona (Woods et al., 2015). While some AVH are anonymous or impossible to differentiate, many are recognized as having a distinct identity (Nayani & David, 1996). This identity may be spiritual or supernatural in nature (e.g. God, an angel, a djinn), reminiscent of people spoken to in the past (McCarthy-Jones, Trauer, et al., 2014), or perceived to be a real-life individual (the musician Prince, for example; Strand, Olin, & Tidefors, 2015). Perhaps most common are descriptions of AVH that do not necessarily have a fully personified and named identity, but nevertheless have consistent trope-like or stereotypical qualities, such as the voice of a doctor or policeman, or an upper class BBC voice (Nayani & David, 1996).

Beyond identity, many voices in AVH also “behave” in ways that suggest independent agency (or, at least, are described by voice-hearers in terms that suggest so). Almost by definition, the core of the AVH experience is a strong feeling of otherness – that someone else is generating this voice, rather than oneself (Leudar & Thomas, 2000). In addition to this, however, what voices say and how they say it can often imply the presence of a speaker with beliefs and desires independent of the voice-hearer. For instance, while the content of AVH may very often be overt in its meaning, voices can also be sarcastic or evasive (Leff et al., 2014). AVH are also described in some cases as imparting knowledge unknown to the voice-hearer (e.g., Azuonye, 1997). In both situations, AVH are perceived as conveying meaning from an underlying agentive source, rather than simply being anomalous, auditory events (see Deamer & Wilkinson, 2015, for a discussion of this idea).

This combination of identity and meaning allows AVH to have a strong interpersonal presence with their own social power (Paulik, 2012). Many voices are described as commanding or commenting on the voice-hearer (McCarthy-Jones et al., 2014), while moral judgements and derogatory statements are also common (Birchwood & Chadwick, 1997). Their impact is magnified by being perceived as coming from a powerful or authoritative source that would have social power in the outside world

(such as a doctor). This clearly has an emotional effect on the voice-hearer, but it also has other consequences that follow from being addressed or talked about by another agent: if an AVH voice speaks it is difficult to ignore, just as it would be difficult to ignore someone with social rank speaking directly to you in the outside world. This is reflected in how voice-hearers talk about the voices that they experience: AVH are often described in interpersonal terms, as if they are agents to be related to, rather than simply sounds to be heard (or ignored). Based on these characteristics of AVH, Bell (2013) argues that voices are as much hallucinated social identities as they are hallucinated words or sounds, and that the experience of auditory verbal hallucinations is, for most voice hearers, primarily a social one (p1).

This view is further elaborated by Wilkinson and Bell (2015), who propose four levels of agency that occur in AVH, ranging from voices with no agent-like qualities or clear identities, through to voices with specific identities in the outside world (such as a relative or a celebrity). Although Wilkinson and Bell acknowledge that not all voices present with such qualities, they argue that the majority of AVH experiences can be seen to involve complex and sophisticated forms of agency representation, and that, at root, what may underlie many AVH is a natural tendency to recognize such social agents in our environment.

This claim draws on a second argument, which relates to the form of AVH. Despite their definition as auditory, perceptual phenomena, the voices described by voice-hearers often take complex, varied, and sometimes paradoxical phenomenological forms. In his descriptions of hallucinations in people with schizophrenia, Bleuler (1950) referred to cases of 'soundless' voices, in which patients would describe the feeling of directly receiving messages or commands from another without apparent auditory phenomenology (p.110). Indeed, what Bleuler's patients referred to as 'voices' varied considerably in auditory qualities: one voice-hearer describes voices occurring in his memory or behind his ears, while another states 'I do not hear it in my ears. I have the feeling in my breast. Yet it seems as if I heard a sound' (p.111). The same kinds of descriptions of AVH are seen in contemporary surveys, including voices that are experienced as being similar to thoughts or memories (McCarthy-Jones, Trauer, et al., 2014) and voices that are experienced without being heard (Woods et al., 2015).

Perhaps most paradoxical are cases of hearing voices described by deaf people with psychosis. A variety of case reports have previously documented deaf people describing voice-like experiences that seem to possess many of the same unusual characteristics of AVH as described by the hearing population (e.g. du Feu & McKenna, 1999; see Atkinson, 2006, for a review). While this was taken by some as evidence of actual auditory experiences, subsequent close analysis of such accounts by Atkinson et al. (2007) has demonstrated that literally auditory phenomenological features tend to be confined to those with experience of spoken language prior to deafness (or via hearing aids). In others, such as people who are congenitally deaf, accounts of loud voices are more associated with invasiveness and intrusion; the experience of being talked at rather than hearing something *per se*. Irrespective of auditory phenomenology, though, other features of voices are evident across different accounts of people who are deaf, including the feeling of being addressed by another person or a being with a distinct identity (for example, one participant described seeing and being talked to by 'God's moustache'; Atkinson, Gleeson, Cromwell, & O'Rourke, 2007, p. 351).

Examples of soundless voices and voices in deafness justifiably raise the question of whether such experiences should be considered as hearing voices at all. In the former case, some would classify voices without sound as examples of inserted thoughts instead, which often co-occur with hallucinations (Badcock, 2015) but are considered a

separate experience in psychiatric terminology. In the latter case, examples of voices in deafness actually include a number of other modalities, including visual, tactile, and olfactory experiences. But – crucially – these experiences are nevertheless labeled as voices by the people who have them. This raises the question of what exactly *is* being referred to by term voice, in the absence of hearing or sound.

As noted by Wilkinson and Bell (2015), what the examples of soundless voices and apparent AVH in deafness point towards is the consistency of agency representation and a feeling of communication in descriptions of voices, irrespective of auditory phenomenology. Put another way, what counts as a voice does not appear to depend on sound, so much as the identity and the perception of meaning being conveyed. If one grants that such variations in unusual experiences are nevertheless indicative of the same (or at least, closely related) underlying phenomenon, then this suggests that the voices described by voice-hearers can actually be present in various sensory modalities. In support of such an idea are anecdotal accounts of voices varying their form across time in the experience of individual voice-hearers – for instance, a voice that usually speaks may appear as a vision instead – or descriptions of voices that can have a felt presence apparently even when not speaking, similar to accounts of presence hallucinations in Parkinson’s disease (Fénelon, Soulas, Cleret de Langavant, Trinkler, & Bachoud-Lévi, 2011). In the latter examples, the use of the term ‘voice’ by a voice-hearer is arguably not referring to the description of an auditory experience, so much as tracking its perceived presence or identity across time.

### *1.2 An objection: Social features of AVH are merely secondary appraisals*

If one grants that voices can seem to be social, it could still be suggested that this is just a secondary phenomenon: an elaboration by the voice-hearer to explain what is going on. One way in which the more personified and socially complex features of AVH can be viewed is as an *appraisal* of hearing a voice. That is, it could be suggested that the perceived identity and intention of a voice is not part of the perceptual experience *per se*, but an interpretation of that experience that occurs after the fact.

The background for thinking of the social characteristics of AVH in this way lies in the common co-occurrence of hallucinations and delusions, both in psychosis in general and schizophrenia more specifically. In schizophrenia, AVH are often accompanied by delusional and grandiose interpretations of where the voices may arise from, such as a belief that the CIA is sending one messages (Frith, 1992). Similarly, for the voice-hearer who believes that celebrities are talking to her even when they physically cannot be, or AVHs that are experienced as the voice of an evil spirit, it seems that the presence of delusional beliefs is the most likely explanation for strongly personified voice experiences. Delusional beliefs of this kind may also represent a reaction to an unusual perceptual experience, or indeed fuel further personification of subsequent hallucinations, creating a complex feedback loop of appraisal and sensation. But irrespective of this relationship, the argument is that the ‘social’ qualities of a voice arise from delusional reasoning primarily (for an example of this idea, see Frith et al., 1996).

In this context, descriptions of agency, identity and intention behind a voice would be no more than elaborations driven by a developing psychosis. A strong interpretation of this argument would be to say that the apparent social characteristics of voices are separable phenomena that occur concurrently with AVH in some people, but do not tell us anything about the core experience of hallucination. For example, the contents of a voice may be fairly repetitive and neutral, but a voice-hearer comes over time to believe that they are messages sent by a malevolent entity. A weaker and more conciliatory claim would be to say that these features are part of the overall experience, but are nevertheless still secondary appraisals to the primary perceptual disturbance, e.g. a

voice-like experience that becomes social and agent-like over time as a result of delusional interpretation. In either case, the presence or absence of social and agent-like characteristics in AVH does not change their phenomenal core as anomalous voice perceptions, and so there is no immediate imperative for explanatory models to offer a full account of the social aspects of voice-hearing.

This interpretation is clearly at odds with Bell (2013) and Wilkinson and Bell's (2015) project, especially if they wish to propose that the social features of AVH are important in any sort of primary way. However, there are various ways to respond to this objection. One response is to question whether delusional interpretation is relevant to understanding all or most kinds of AVH. As noted above, AVH are most commonly associated with schizophrenia (occurring in 60-90% of cases; Bauer et al., 2011), but they also occur in a range of other psychiatric disorders, only some of which are associated with delusions. AVH also occur in non-psychiatric populations: these non-clinical voice-hearers tend to have magical or spiritual interpretations of their voices (Daalman et al., 2010) and score higher than controls on trait measures of sub-clinical delusional traits (Sommer et al., 2010), but do not have pathological delusions of the kind described above. Non-clinical voice-hearers also describe voices with similar levels of personification and individuation as those in clinical accounts, suggesting that social characteristics of AVH are not absent in healthy voice-hearers (Daalman et al., 2010; Leudar, Thomas, McNally, & Glinski, 1997). Therefore, AVH with social identities are not easily dismissed as delusional interpretations of the kind that might be associated with psychotic disorders generally, even if in some cases – particularly for schizophrenia – delusion may play a strong part in their presentation.

But even if we grant that not all social features of voices are driven by *delusional* interpretations, it might still be argued that they are, nevertheless, interpretations; i.e. secondary appraisals of perceptual events. Even if the voice isn't from the CIA, it could have developed over time as a result of interpretation and expectancy on the part of the voice-hearer. A potential response then could be to examine how AVH first emerge and examine either social features of the experience or social factors that precipitated it, such as a period of social isolation (Hoffman, 2007) or some form of socially distressing or traumatic experience (Corstens & Longden, 2013).

For instance, Daalman and Diederer (2013) describe the example of Christine, whose voices started with her hearing the sound of a baby's cries that she could not locate. This later developed into the presence of a female voice that spoke her name, and then other voices that said progressively more unpleasant things. On the one hand, it is unclear that Christine's experience was of a fully formed, agent-like voice when her experiences first began; more agentic (and malevolent) characteristics are clearly more present at a later stage. On the other hand, the first experience was one involving an apparent social identity (a baby) whose presence placed a social demand on the voice-hearer (Christine describes searching for the baby to help it and becoming more distressed when she could not; see Scholtus & Blanke, 2012). In this instance, the nature of the AVH may have changed over time, but the presence of a social entity could be argued to be present from the start, rather than being a product of secondary appraisals.

Although there are a number of narratives and retrospective accounts from voice-hearers that describe the very first experiences of voices (e.g. Romme, Escher, Dillon, & Corstens, 2009), empirical research on the phenomenology of this process is lacking. Moreover, for every case in which apparent social or agent-like characteristics are present from the onset, there are likely to be examples where more basic or neutral unusual experiences form the beginnings of AVH. To date, although some small longitudinal studies exist (e.g. Hartigan, McCarthy-Jones, & Hayward, 2014), there are

no good quality empirical data on the developing phenomenology of AVH from their onset.

To look for evidence of social qualities of AVH in their onset also potentially characterizes Bell and Wilkinson as making a stronger claim than they would otherwise want to make. If the use of the term 'primary' is taken as constituting a chronological and causal claim, then it would need to be demonstrated that social characteristics are present in AVH right from their beginnings. If, however, 'primary' is taken more as a descriptive claim about the experiential impact of AVH, then whether social features arise before, during or after the initial phase of anomalous experiences is not as important as continued presence over a longer period of time<sup>1</sup>. That is, the first experience of AVH may be fairly non-social, but the experience may quickly take on social and agent-like properties that preoccupy and distress the voice-hearer for years to come. In this case it would be reasonable to argue that voices are primarily experienced as social entities and to try to address them in that way in therapeutic approaches, even if chronologically such factors were not primary.

A response with a stronger empirical basis is to question the presumed division between the perception of a voice and its social appraisal, whatever that consists in. A key part of Wilkinson and Bell's (2015) argument for agent-like representations being important to AVH is that our perceptual systems are set up to automatically detect social information in our environment. Drawing on (largely visual) examples of intention understanding in infancy, they argue that we have a natural propensity to recognize and track social agents, and that this is expressed in the ways that voice-hearers describe their experience of AVH. Everyday recognition of voice identity and tone of voice is fast-acting, and likely relies on specialized cognitive processing in a similar way to familiar face recognition (Badcock & Chhabra, 2013; Grossmann, Oberecker, Koch, & Friederici, 2010). Therefore, the same argument could be made for AVH: if we are set up to recognize agency in general and to recognize social cues in voices specifically, then why think that hallucinatory voices would be treated any differently?

Empirical support for this view comes from recent findings that adult processing of mental states is best explained in terms of a dual-route model, comprising a fast but inflexible capacity for tracking belief-like states alongside a later-developing, more sophisticated capacity for reasoning about other minds (Apperly & Butterfill, 2009). But a note of caution is provided by the developmental psychology literature on theory-of-mind acquisition (e.g. Apperly, 2010), which testifies to the extent to which attributing intentionality to another agent involves multifarious processes operating at differing levels. For example, infants' early developing understanding of others as intentional agents (e.g. Woodward, 1998) takes considerable time to develop into a fully-fledged representational theory-of-mind, a developmental process (Tomasello et al., 2005) that arguably implicates processes other than purely social-cognitive ones (Fernyhough, 2008). As such, while the evidence may be sufficient to reject the claim that recognition of social cues in voices is purely a kind of secondary appraisal, it isn't necessarily clear which of the many distinct levels of social-cognitive understanding are necessary for the attribution of agency to occur.

In summary, there is considerable evidence that AVH often have social characteristics, and in some cases this seems evident even in the absence of specifically auditory phenomenology – leading to the suggestion that it is useful to think about them in terms of social, agent-like representations rather than simply auditory phenomena. Some AVH

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<sup>1</sup> There is also a third sense of primacy relevant here: explanatory primacy, in which social factors may be key to explaining *why* a voice-hearer has the voices they experience. We thank Sam Wilkinson for this point.



may have a social identity that arises from the co-occurrence of delusions, but this fails to account for social AVH occurring outside of psychosis. Furthermore, suggesting that social features of AVH are only secondary appraisals does not appear to be consistent with how we rapidly and automatically recognize the agency of voices in ordinary perception; suggesting that such cues are not easily divorced from the primary experience of a voice.

## **2. Explaining the social characteristics within existing models of AVH**

If one accepts that agent-like or social characteristics of voices are important aspects of AVH that need to be explained, then they need to be accommodated in explanatory models of voice-hearing. This section will briefly introduce three current neurocognitive approaches to AVH, emphasizing inner speech, memory, and predictive processing respectively. Sections 3 and 4 will then discuss additions and alterations that may account for social properties in a more effective way.

### *2.1 Inner speech models*

The most developed cognitive model of voice-hearing explains AVH in terms of misattributed inner speech. The origins of this approach come from theories of motor function in the brain, in which actions are accompanied by an efference copy that prepares sensory systems for the perceptual consequences of a self-generated action (Grush, 2004). Disruption to this process is thought to create a mismatch in the comparison between self-generated actions and their expected sensory consequences, leading to a feeling that one is not the author of the action itself. Following Feinberg (1978), Frith (1992) applied this comparator model to schizophrenia to account for its constellation of unusual experiences, including AVH. For hearing voices, the comparator model is usually interpreted as involving a mismatch between the prediction and generation of instances of inner speech, leading to them being experienced as an alien and external voice (Allen et al., 2007; Seal, Aleman, & McGuire, 2004).

A full evaluation of inner speech models of AVH is beyond the scope of this article (see Jones & Fernyhough, 2007), but summarized briefly, there are thought to be a number of drawbacks with the comparator approach, despite a range of converging sources of evidence to suggest that speech processing is disrupted in those prone to AVH. On the one hand, inner speech models have been variously criticized for failing to chime with the subjective experience of AVH (Waters, Badcock, Michie, & Maybery, 2006); not accounting for concurrent non-verbal phenomena that accompany AVH (Waters & Jardri, 2014); relying on a questionable monitoring process of inner speech (Gallagher, 2004), and failing to account for the auditory properties of AVH (Cho & Wu, 2013). On the other hand, fMRI studies of hallucination capture often highlight brain regions associated with inner speech production (Jardri, Pouchet, Pins, & Thomas, 2011; Kühn & Gallinat, 2012; although see van Lutterveld, Diederer, Koops, Begemann, & Sommer, 2013); people with schizophrenia and AVH show specific functional and structural differences in the connections between brain regions associated with speech production and comprehension (Geoffroy et al., 2014; Whitford et al., 2011), and there is evidence that some AVH are associated with movements in the lip, tongue and throat musculature as they occur (Gould, 1950; Rapin, Dohen, Polosan, Perrier, & Loevenbruck, 2013).

However, the key question for inner speech models regarding the social properties of AVH is how they account for a perception of a personified other – a point noted very early on in the genesis of such approaches (Frith et al., 1996). If inner speech, as it is commonly understood, is regarded as an internal monologue in one's own voice, then

how does it come to sound and speak like another person? Disruptions to the sensory prediction process could plausibly provide an account of why a cognition may be experienced as alien – in the sense of not being self-generated – but do not go much further in explaining why another voice in particular, with a distinct identity and personality, would be experienced by the voice-hearer. Indeed, possibly because of the comparator model's origin in psychosis (rather than AVH specifically), such experiences have instead traditionally been explained in the context of co-occurring delusional beliefs rather than hallucination, as discussed above.

## *2.2 Memory-based explanations*

Memory models of AVH differ from inner speech models in their emphasis on where the raw material of AVH comes from. Although memory-based approaches are various in their specification, most propose that auditory hallucinations at core result from intrusions from memory (e.g. Waters et al., 2006). In support of such an idea, there is evidence that people with schizophrenia and AVH have difficulty with controlling intrusive or irrelevant memory (referred to as intentional inhibition; Waters et al., 2003); voice-hearers often describe their AVH as being reminiscent of previous interactions with others (McCarthy-Jones, Trauer, et al., 2014); and there is evidence of activation changes in the hippocampus and surrounding structures prior to and during the onset of AVH (Diederer et al., 2010; Jardri et al., 2011). However, unlike inner speech models, memory-based approaches in general do not offer a clear mechanism by which memories become misattributed to an external source as an AVH. There is some evidence that binding of memories to their context is impaired in people with AVH (Chhabra, Badcock, & Maybery, 2013), suggesting that impaired encoding of events could lead to their later misattribution, while researchers working from a trauma-based approach have argued that dissociative responses to serious adverse experiences could fragment ordinary memory processing (Longden, Madill, & Waterman, 2011). But why and how prior experiences would 'resurface' as a hallucinatory voice, in some cases many years later, is not well understood within current models of autobiographical memory. This issue is particularly salient given that verbatim memory for verbal material is generally poor (Sachs, 1967), meaning that voices are unlikely to be unreconstructed representations of what was uttered at remembered events.

Despite these caveats, memory models are better placed than standard inner speech models to account for social characteristics of AVH because they can appeal to the social content of autobiographical memory: voices can simply sound like agents with social power because they are linked to memories of prior experiences involving such agents or situations. And if those AVH are in some way prompted by traumatic experiences, then this would appear to explain why particular identities, with social rank and social power, are perceived in the voices that speak: it is not uncommon to hear individual voice-hearer accounts of AVH that sound like people who previously acted as persecutors or abusers in the external world (Corstens & Longden, 2013).

There remains a further question of how memories of prior events come to be transformed into new and agent-like experiences. AVH are described as direct replays of events in a minority of cases (McCarthy-Jones, Trauer, et al., 2014), meaning that most would have to be reconstructions some kind – as indeed, most memories are (Roediger & DeSoto, 2015). But reconstructed or not, most memories arguably do not often take on a life of their own and start responding to, commenting on, or conversing with the person doing the remembering in novel ways. The impetus behind that transition – from memory to new experience, from recall to perception – cannot be accounted for within existing memory models of AVH. However, this is more of a general problem with such models, rather than a problem specific to the understanding of voices as social agents.

Compared to other competitors, memory models can at least account for much of the social *content* of voices.

### *2.3 Predictive processing approaches*

Predictive coding approaches are the most recent contribution to the field of explanatory models for AVH. Following Friston (2005), this framework broadly attempts to provide an account of all perception and action processes in terms of prediction. Rather than view perception as a matter of passing bottom-up sensory signals through a hierarchy of progressively more complex cognitive processes, it posits that top-down prediction drives the vast majority of perceptual processing, with only unexplained signal (prediction error) being passed up the cortical chain (see Clark, 2013, for a review). Varieties of this approach have been applied to the symptoms of schizophrenia – including AVH – by Fletcher & Frith (2009), Jardri & Denève (2013), and Wilkinson (2014), among others.

Predictive processing accounts for AVH in terms of an imbalance between a predicted sensory state and prediction error. In this respect, it is actually very close to comparator-based models of inner speech and AVH. However, unlike such motor-based models, predictive processing does not posit any comparison between prediction and action; there is only internal prediction, and this can account for more or less of the underlying sensory signal (Pickering & Clark, 2014). If this signal is not accounted for in the usual way, then aberrant perceptions such as AVH are proposed to occur (perhaps because top-down predictions become confused with bottom-up signal; Jardri & Denève, 2013). Predictive models also do not rely on a self-generated instance of inner speech (or anything else) to produce an AVH; under the model, hallucinations could simply arise from the brain's attempt to predict and model its sensory environment, from moment to moment. And while it is still a relatively new approach to understanding AVH, there is some evidence that such processes are selectively disrupted in voice-hearing: for instance, Horga et al. (2014) observed aberrant modulation of auditory cortex in relation to expected sound in people with schizophrenia and AVH.

How predictive models account for complex, social characteristics of AVH depends on what is permitted to enter into a prediction. Predictions are shaped by priors; constraints on the sensory expectation driven by earlier experience. Priors at different levels of a predictive processing hierarchy are proposed to shape different levels of expectation, the further up one ascends. As such, it is possible to accommodate these kinds of properties into the predictive processing framework, with perceptions of voice presence and location being processed at lower sensory levels, and expectation of voice tone, meaning and identity being processed at higher (or at least different) levels (Badcock, 2015). Thus, voices sound like agents because somewhere in the hierarchy there is a sufficient set of priors and expectations to predict a voice with identity and agency, and this prediction fits the ambiguity present in bottom-up signal – or is given undue weight compared to other kinds of predictions being made.

Though logically possible, this explanation also feels unsatisfactory: invocation of special priors for special properties, somewhere higher up the cortical hierarchy, does not feel like it does any explanatory work to really account for the social characteristics of AVH. It only really says that AVH are experienced as social entities because voices are expected to be social – without offering an account of *why* we might expect this; it begs the question as to how either strong priors or overly weighted predictions of social voices came to exist in the first place. It also chimes with a general criticism of how the predictive processing approach currently accounts for cognitive processes that may be one-step removed, or more qualitatively complex, than immediate sensory perception.

Namely, it has been suggested that positing higher and higher levels of prediction, with no real difference in the kinds of inputs and outputs, for higher levels of cognition – a desert wasteland as termed by Clark (2013) - does not provide a satisfactory account of how complex and value-laden internal states such as reward, value, and desire seem to differ from immediate sensory processes. This may change with further elaboration of how predictive processing could support higher cognitive processing (see, for example, Seth, 2013, on predictions about emotions), but for now, predictive approaches do not seem to offer a particularly nourishing account of how or why AVH are experienced as having specifically social characteristics. In this respect, the predictive approach offers a potential framework for understanding a range of properties of AVH (see also Wilkinson, 2014), but little detail on why exactly voices appear to have such social presence.

To summarize this section: standard inner speech models offer very little in the way of an account of social characteristics of voices, while memory- and prediction-based approaches can more easily accommodate social features, but with variable explanatory power. Memory models can appeal to prior experiences being social in nature and shaping the subsequent AVH, but are constrained by a more general question of how autobiographical memories become new experiences of voices, while predictive approaches can include social expectations, but offer no further account of why predictions about voices would be especially social. In the next section we examine whether a completely different, social-cognitive model of AVH is needed.

### **3. Social-cognitive explanations for AVH**

If existing explanations of AVH are unsatisfactory, then other neurocognitive systems may be better placed to provide a more convincing account, specifically in terms of their social functioning. This is the position that Bell (2013) takes, having outlined the lack of social characteristics in existing speech and monitoring models of AVH:

‘The hypothesis suggested here is that, in addition to these well-established factors, there is an alteration to the social cognitive or social neurocognitive systems that support internal models of social actors and their associated voice imagery, to explain why voices are typically experienced as having an identity and acting socially’ (p3).

Drawing on fMRI research by Hassabis et al. (2014), what Bell advocates is something like a disruption to personality models of agents; i.e. complex, schema-like knowledge of how individuals appear and behave consistently across time, that both allows them to be tracked and identified, and means that their actions can be anticipated or understood. That is, we may *all* have representations of agents that we carry with us, at all times, to facilitate effective social functioning. And in AVH, these models come alive.

While this is a promising avenue for understanding social agency, little is known about how we represent and process other agents in this way. In Hassabis et al.’s (2014) study, participants learnt about the personalities of four new agents, and then imagined them in particular scenarios. Their results suggested that construction and representation of agents depended on a mixture of their personality traits: agreeableness, for example, was processed by slightly different neural regions to extraversion, while their combination could be used to pick out which agents were being thought about at a given time. Based on the brain regions involved in this process, Hassabis et al., (2014) argued that the brain builds unique personality models of agents, which then facilitate predictions about their future behavior and other kinds of social planning. More recent work by De Brigard et al. (2015) indicates that thinking about agents recruits different neural resources depending on how familiar others are and how similar they are to our own personality. Finally, feelings of others being present is often linked to disruptions to neural systems responsible for mapping one’s own body in space (Peer, Salomon,

Goldberg, Blanke, & Arzy, 2015), suggesting that felt presences associated with voices may occupy an embodied, experiential space in between the cognitive and perceptual experience of another. To date, though, little of this work has been applied to groups of people with AVH, meaning that it is simply unknown whether they contribute to voice-hearing in any way.

A more established tradition of social-cognitive research in relation to AVH exists in work on theory-of-mind, or the ability to represent the mental states of others. A large number of studies have documented theory-of-mind impairments in people with schizophrenia, their first-degree relatives, and those at risk of psychosis (e.g. Bora & Pantelis, 2013). If theory-of-mind is somehow disrupted in schizophrenia, it seems plausible that attributions of intentions and other mental states to AVH could give rise to the apparent social characteristics of voices. Indeed, it has been previously proposed that people with schizophrenia may be liable to hyper-mentalizing about non-social stimuli, leading to paranoid delusions and hallucinations (Ciaramidaro et al., 2015; Crespi & Badcock, 2008).

The problem with this idea, though, is that theory-of-mind performance in this group would appear to go in the other direction, i.e. *difficulty* with attributing mental states accurately, rather than a tendency to over-attribute them to others. This is reflected in the relationship between theory-of-mind and clinical symptoms: in general, problems with mentalizing in schizophrenia do not correlate with positive symptoms such as hallucinations and delusions, but do associate with negative symptoms, such as social withdrawal and anhedonia (e.g. Savla, Vella, Armstrong, Penn, & Twamley, 2013). If disruptions to ToM were also prompting the social features of AVH, they would be doing so in a very indirect and unusual way. As such, it seems unlikely that problems with theory-of-mind are strongly influencing the makeup of AVH, even if it is a feature of schizophrenia more generally.

A parallel account that is also important to consider in the context of social AVH is Hoffman's 'social deafferentation' hypothesis of schizophrenia (Hoffman, 2007). In a theory designed to account for the onset of schizophrenia in general, including both hallucinations and delusions, Hoffman draws together three lines of evidence to suggest that psychotic symptoms can be caused by social deprivation during critical periods of development. First, schizophrenia is often associated with a period of social withdrawal, which some studies indicate precedes symptom onset. Second, sensory deprivation, leading to deafferentation of normal sensory inputs, is often linked to hallucinations and illusions (as in a number of degenerative disorders, such as Charles Bonnet Syndrome). Finally, both hallucinations and delusions often have strongly social and interpersonal content (as summarized above). Analogous to sensory deprivation, Hoffman argues that 'severe social withdrawal in humans during critical developmental periods induces deafferentation-like reorganization in regions of association cortex underlying social cognition that consequently produce spurious experiences with social meaning' (p1067). Within this framework, AVH are social because they are a specific response to a lack of social input in the environment.

Thus, there may be ways in which some of the more personified or agent-like characteristics of AVH could be understood, either in terms of concurrent disruptions to social-cognitive systems, or by appealing to the impact of social withdrawal on sensory systems. It is important to note also that such explanations are not mutually exclusive; in particular, Hoffman's sensory deafferentation account focuses on the potential causes and developmental changes in perception that might give rise to social AVH, leaving

open how cognitive representation of agents or mental states may be operating<sup>2</sup>. Further work in particular on how personality models are developed and retained in our interactions with others seems likely to be important for understanding agent-like AVH.

But, if such factors do hold the key to understanding social voices, then they seem to require a commitment to positing multiple cognitive processes that give rise to AVH; that is, in addition to apparently atypical language and memory processes, there may also be some kind of social-cognitive factor that creates agent-like voices. This is possible – indeed, contemporary cognitive approaches to AVH largely embrace the presence of multiple routes towards AVH and potentially multiple kinds of voices (McCarthy-Jones, Thomas, et al., 2014; Waters et al., 2012) – but it is, nevertheless, a solution that lacks explanatory parsimony. The alternative, discussed in the following section, is to reconsider the social information that may be inherent in our ordinary processing of internal and external language.

#### **4. Social inner speech, prediction as dialogue, and interpersonal affordances.**

If experiences of hearing social and agent-like voices could arise without any recourse to social-cognitive systems, then important information regarding social identity and social interaction would already have to be inherent in speech and language processing. That is, inner speech, speech comprehension, or some other process using the same resources, would already have to ‘be’ social; operating specifically *for* social interaction, or regularly representing not only one’s own voice, but also those of others. There are at least three ways that the social information apparent in AVH could be accounted for in this manner: dialogic inner speech, prediction in speech comprehension, and direct perception of voices as social objects.

##### *4.1 Inner speech as a social process*

A common assumption about inner speech is that it is a relatively uniform, internal process- something akin to external speech, but with the volume down. It is usually understood as a kind of internal monologue, and presented as merely consisting in subvocal articulation of ongoing thoughts and concerns. For example, Levine et al. (1982) refer to inner speech as ‘the subjective phenomenon of talking to oneself, of developing an auditory articulatory image of speech without uttering a sound (p.391)’.

But this arguably underestimates the flexibility and complexity of inner speech as a process. Firstly, phenomenological surveys of inner speech suggest that engagement in dialogue, self-evaluation, and thinking about what other people would say are common features of everyday self-talk (Alderson-Day et al., 2014; McCarthy-Jones & Fernyhough, 2011). Secondly, there is considerable evidence of inner speech being deployed in online cognitive control, thinking about the future, reasoning about others mental states, and motivating current behavior, for example (Alderson-Day & Fernyhough, 2015; Perrone-Bertolotti, Rapin, Lachaux, Baciú, & Lœvenbruck, 2014).

If misattributed inner speech could form the bases of AVH, even when those with AVH present with a strong sense of their own identity and character, one would have to posit that everyday inner speech involves vivid representation of other agents as well. But Fernyhough (2004) has argued that this is less implausible than it sounds, if one pays attention to the early development of inner speech. As argued for by Vygotsky (1934/1987) and others (e.g. Berk, 1992; Winsler, Fernyhough, & Montero, 2009), inner speech is thought to be structured by early social interactions with others, providing an

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<sup>2</sup> We thank reviewer 1 for highlighting this point.

internal model for later social interactions and other higher cognitive processes. Applying this model to inner speech and AVH, the social representations apparent in voice-hearing would be a direct reflection of the ‘otherness’ of inner speech, i.e. the extent to which our own internal monologue is steeped in representations of the words of others (Fernyhough, 2004).

Such an understanding of inner speech is not necessarily intuitive and requires further testing of its central claims. Some have questioned whether we should consider inner speech involving dialogue as an example of inner speech or some kind of auditory imagery, and if so, whether that would actually involve very different cognitive and neural processes (Gregory, 2015; Hubbard, 2010). We have argued elsewhere (Alderson-Day & Fernyhough, 2015) that inner speech *could* be considered an example of auditory verbal imagery, but that it also draws on specific neural processes (motor processing associated with articulation) in addition to resources shared by other kinds of imagery. Nevertheless, it is fair to say that allowing dialogue and the identities of others into inner speech constitutes a broadening of its common definition.

Investigating the phenomenology of inner speech also presents a range of challenges, as it almost always relies on the fidelity of introspective reports. To counter this, some studies have utilized experimental paradigms that depend on inner speech being used, but have a behavioral outcome (e.g. judging the metric stress of particular words; Aleman et al., 2005), but such measures also inevitably move away from more naturalistic and spontaneous examples of everyday inner speech. However, relevant to AVH, there is preliminary evidence that producing dialogues in inner speech prompts use of similar regions to theory-of-mind tasks that rely on deciphering others’ communicative intentions (Alderson-Day et al., 2015). This suggests that running through past or future conversations in inner speech may involve the representation of other’s mental states: if this is the case, then disruptions to inner speech could conceivably involve changes in the representation of other agents also – giving rise to some of the “otherness” of AVH.

#### *4.2 Predictive and interactive processes in speech perception*

An alternative option is to think about how normal speech perception may draw on predictive processes that cue the listener for social interaction. It is relatively accepted that the neural processing of listening to speech involves not only areas of the brain classically associated with speech comprehension, (such as Wernicke’s area, in the posterior superior temporal gyrus & sulcus), but also parts of motor cortex more commonly linked to speech production (Hickok & Poeppel, 2007). One way of interpreting this is that perception draws on sensorimotor predictions of others speech to facilitate comprehension, using similar predictive processes to those involved in models of external (and internal) speech production, i.e. in the form of motor plans for how one could produce the same utterance. For instance, Pickering and Garrod (2013) argue that ordinary speech production and comprehension systems actually draw on the same resources to allow for real-time decoding of others utterances and fast switching between speaking and listening. Alternatively, Scott et al. (2009) has argued that motor cortex involvement is not an indicator of its use in speech comprehension *per se*, but marks the preparations a speaker needs to make in order to respond; a marker of turn-taking in conversation, rather than action-based comprehension processes.

In the approach of Pickering and Garrod (2014), listening to speech and understanding it inextricably involves motor prediction. For Scott and colleagues, in contrast, motor cortex is not part of the comprehension process, but necessary for coordinating joint action. In either case, the important point is that hearing a voice is not just about passive

recognition of voice content or form; it is a stimulus that is recognized or reacted to in a highly active (and apparently automatic) way, such that we generally don't 'do' speech perception without also in some way being ready for interaction. Applying this to AVH, it could be argued that much of their 'pull' – their capturing of attention, intrusion into consciousness, and apparent social power – depends on very basic responses to recognized speech: a voice is heard, and it has to be responded to as if it were something to be interacted with – *as if it were an agent*. This would not explain the range of social content apparent in AVH, but offers a basis for why voices appear to have such interactive potential in their experience.

#### 4.3. *Voices as affordances*

An alternative approach is to posit that voices somehow directly contain social properties. While classical approaches to perception may divide sensory percepts from knowledge about their use or identity, ecological approaches to perception (as famously advocated by Gibson, 1986) propose that such information is inherent in the sensory environment, in the form of affordances. Affordances are cues to action located in the sensory array – for Gibson, what the environment offers, provides or furnishes the perceiver, in a direct and unmediated way. For example, the seeing of a hammer and knowing how to use it are not separable processes of perception and cognition: perceiving a hammer is also to perceive how it may be picked up and used.

If voices were considered the kinds of things that could have affordances, this would mean that when a voice is heard (even as a hallucinatory voice), it would not be treated as a sensory object to which further labels are attached or recognized, however rapidly this might occur. Instead it is experienced immediately as a cue to act. And if voices had affordances, then it seems plausible to think that those affordances would be social: this is something to be listened to, replied to, complied with – a prompt to interact with another agent. In essence, this approach rejects the whole premise of the question at the start of this article: there is nothing more to be added to accounts of AVH to explain their social properties, if we understand that *all* voices contain social information. If voices have social affordances, there is no division between hearing a voice and experiencing a social entity.

Empirical psychological approaches to social cognition have generally privileged inferential over ecological explanations of the attribution of mental states (e.g. Perner, 1991). A notable exception is Hobson (e.g. 1993), who proposes (following Wittgenstein, 1980, among others) that mental states, particularly emotions, are perceived directly. According to Hobson (1991), the development of social-cognitive skills is dependent on and inextricable from interactions in the environment, via experiences of shared attention and communication with others in childhood. Thus, when a voice is heard (whether it is a veridical experience or not), experiencing it *as* a social entity that can convey meaning and prompt interaction is no surprise; if anything, it is to be expected.

This position is supported by the empirical literature cited above highlighting rapid and automatic detection of social cues and agency by children and adults. And in this respect, the direct approach may appear to return the argument to Wilkinson and Bell's (2015) position; namely that the recognition of agents is a fast and automatic process, evident at a young age, that could underlie the tendency to experience voices as agents. But thinking of mental states and other socially important information being directly perceived in the environment – as Hobson might – pushes the argument further. Instead of suggesting that we are expert agent detectors by virtue of having specific cognitive modules or skills *in ourselves*, the proposal instead is that the recognition of speech and language in our environment is irreducibly social and dependent on external interactions. In this respect, Hobson's approach is closer to a kind of radical enactivism



about social cognition than, for example, an appeal to internalized personality models (Bell, 2013) or changes in explicit or implicit theory-of-mind skills (Crespi & Badcock, 2008).

Historically, direct theories of perception have been criticized for failing to explain what affordances consist in if the important information is considered out there in the environment rather than in the head – and in this respect, they don't clearly do the explanatory work that the other options outlined in this section do. Furthermore, the strong claim that all voices *have* to be treated socially is clearly untenable; not least if one considers that not all AVH are described as being characterful or identifiable (Woods et al., 2015). Interestingly, though, direct perception of this kind is highly consistent both with theories of speech processing that emphasize readiness for dialogue, such as the work of Pickering & Garrod (2014), whereby there almost is no speech processing without the readiness to act and interact. It is also in line with more general predictive processing theories of perception, in which perceptual objects are seen in virtue of their potential use and future action, rather than being passed on to be processed by higher order systems of belief and motivation (Friston et al., 2012). Thus, affordances may be what we are looking for when we want more from a predictive approach – not a simple perceptual prediction, being informed by even higher and higher levels of esoteric priors, but low level predictions that are treated *as* inherently social or agent-like objects from the onset.

An avenue of research that may shed light on the early recognition of social properties of voices has recently been outlined by Badcock and colleagues (Badcock, 2010; Badcock & Chhabra, 2013; Chhabra, Badcock, Maybery, & Leung, 2012). Drawing on evidence from normal voice perception, Badcock (2010) and Badcock and Chhabra (2013) highlight that voice processing relies on a number of separable neural streams responsible for recognizing specific characteristics, such as speaker identity, personality, and emotional tone. For example, voice pitch and timbre offer key cues to voice gender and age (Latinus & Belin, 2011), while basic dimensional judgements of voice likeability and dominance appear to underlie rapid evaluations of voice personality (e.g. McAleer, Todorov, & Belin, 2014). AVH that have a recognizable identity across time, Badcock and Chhabra argue, could result from different kinds of dysfunction within these specific processing streams. For example, there is some preliminary evidence that people with schizophrenia and AVH had specific difficulties with recognizing speaker identity from external voices (Chhabra et al., 2012; Zhang et al., 2008).

This approach could be treated as an explanation in itself of the social characteristics of AVH, but it is not without its problems. First, it appears better placed to explain social cues that arise from the auditory properties of a voice (such as its pitch), but doesn't offer an obvious account of the more complex and agent-like 'behaviours' of AVH that voice-hearers often describe. Second, as in the literature on theory-of-mind, the relation between dysfunction and phenomenology here is opaque and potentially problematic, in that difficulties with recognizing actual voices in people with AVH do not intuitively translate into a tendency to perceive social identity in hallucinatory voices.

Nevertheless, the work of Badcock and colleagues has much to offer in terms of being a potential framework for investigating how 'directly' social cues are perceived in the case of AVH. The perceptions of voices in stereotypical and trope-like terms in particular could fit nicely with how voices are recognized according to basic dimensional properties in ordinary voice perception (Badcock & Chhabra, 2013). This, coupled with further research on the social nature of inner speech and the close interaction between

systems of speech production and perception, could be combined to map out how voices are both recognized *and treated* as social and agent-like entities by voice-hearers.

## **5. Concluding remarks**

The aim of this paper was to outline the main argument for thinking of voices as social or agent-like representations, and consider the main options available for explaining how such properties come to be attached to AVH. As argued previously by Bell (2013) and Wilkinson & Bell (2015), there are good reasons to think that many AVH are treated as social entities, and current models do not provide a clear account of how social and agent-like characteristics ‘get into’ voices. Inner speech models seem to provide an architectural mechanism for hallucination, but little social content, while memory models do the opposite. Predictive approaches, in contrast remain underdeveloped in terms of offering a satisfactory explanation of why voices appear to be treated in this way.

But arguably existing models can account for more social characteristics than they are given credit for. If we properly consider how social and agent-like information seeps into our ordinary perception of voices, extra mechanisms of agent representation are not necessarily needed to explain why voices may have social content or come to be interacted with in a social way. We have outlined at least three ways in which this can be done: firstly, by considering the social contents of everyday inner speech, and its developmental origin; secondly by acknowledging how much of speech perception and comprehension appears to rely upon motor prediction and cues to interact; and thirdly, by thinking of voices as directly social objects in themselves. Taken together, these show that there isn’t necessarily any need to appeal to separate processes of delusion or social simulation to understand why voices so often appear social; rather, they suggest that in many cases, we may not be able to hear them any other way.

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